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10/758,815

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Yasuo Kitaoka

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HAMRE, SCHUMANN, MUELLER & LARSON P.C.

P.O. BOX 2902-0902

MINNEAPOLIS, MN 55402

EXAMINER

MCCALL SHEPARD, SONYA D

ART UNIT

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/758,815	<b>Applicant(s)</b> KITAOKA ET AL.	
	<b>Examiner</b> SONYA D. MCCALL SHEPARD	<b>Art Unit</b> 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 August 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-15 and 18-29 is/are pending in the application.
- 4a) Of the above claim(s) 24-29 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 and 18-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                       | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>8/29/08</u> .   | 6) <input type="checkbox"/> Other: _____                          |

**Detailed Action**

*This office action is in response to applicant's amendments filed on 29 August 2008.*

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-3, 5-11, 13, 16-23 are rejected under 35 U.S.C. 103(a) as obvious over Kidoguchi et al. (US 6,720,586).

With regard to claim 1, Kidoguchi et al. discloses a method of manufacturing a Group III nitride substrate comprising: forming a Group III nitride layer including gaps 12c on a substrate 11; bringing a surface of the Group III nitride layer into contact with a

melt containing alkali metal and at least one Group III element selected from gallium, aluminum and indium in an atmosphere containing nitrogen, to make at least one Group III element and the nitrogen react with each other to grow Group III nitride crystals on the Group III nitride layer (col. 17, lines 53-60); and separating a part including the substrate 11 and a part including the Group III nitride crystals 14 from each other in vicinities of the gaps 12c (fig. 4). Kidoguchi et al. disclose the claimed method except for a cycle of the gaps is at least 100  $\mu\text{m}$ . It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a cycle of gaps at least 100  $\mu\text{m}$ , since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

With regard to claim 2, Kidoguchi et al. discloses the Group III element is gallium and the Group III nitride crystals are GaN crystals (col. 16, lines 25-26).

With regard to claims 3 and 31, Kidoguchi et al. discloses an atmosphere containing nitrogen is a pressurized atmosphere (col. 17, lines 54-55).

With regard to claim 5, Kidoguchi et al. discloses in figs. 1 and 14 forming a first semiconductor layer on the substrate; forming convex portions by partially removing the first semiconductor layer; and forming the Group III nitride layer having gaps in its portions other than the convex portions by growing a second semiconductor layer from upper surfaces of the convex portions of the first semiconductor layer, wherein in the process the first semiconductor layer and the second semiconductor layer are separated from each other at the upper surfaces of the convex portions. Although

Kidoguchi et al. discloses a first semiconductor layer expressed GaN and not by a composition formula of  $\text{Al}_u\text{Ga}_v\text{In}_{1-u-v}\text{N}$  (wherein  $0 \leq u \leq 1$  and  $0 \leq v \leq 1$ ), and the second semiconductor layer being expressed as AlGaIn and not by a composition formula of  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  (wherein  $0 \leq x \leq 1$  and  $0 \leq y \leq 1$ ), it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the  $\text{Al}_u\text{Ga}_v\text{In}_{1-u-v}\text{N}$  (wherein  $0 \leq u \leq 1$  and  $0 \leq v \leq 1$ ) as the first semiconductor layer and the second semiconductor layer expressed by a composition formula of  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  (wherein  $0 \leq x \leq 1$  and  $0 \leq y \leq 1$ ), since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art MPEP 2144.05.

With regard to claim 6, Kidoguchi et al. discloses an upper C-plane surface (col. 17, lines 53-55).

With regard to claim 7, Kidoguchi et al. discloses a method wherein the convex portions are formed in stripes (col. 17, lines 30-32).

With regard to claim 8, Kidoguchi et al. discloses a method wherein the concave portions that are portions other than the upper surfaces of the convex portions are covered with a mask film (col. 17, lines 38-40).

With regard to claim 9, Kidoguchi et al. discloses a method wherein the mask film contains at least one selected from a group consisting of silicon nitride, oxide silicon, nitride oxide silicon, aluminum oxide, aluminum nitride oxide, titanium oxide, zirconium oxide and niobium oxide (col. 17, lines 38-40).

With regard to claim 10, Kidoguchi et al. discloses a method wherein the mask film is made of high melting metal or a high melting metallized material (col. 20, lines 42-45).

With regard to claim 11, Kidoguchi et al. discloses a method wherein the mask film contains at least one selected from a group consisting of tungsten, molybdenum, niobium, tungsten silicide, molybdenum silicide and niobium silicide (col. 20, lines 42-49).

With regard to claim 13, Kidoguchi et al. discloses a sapphire substrate (11) (col. 16, lines 14-16).

With regard to claim 18, Kidoguchi et al. discloses a method of manufacturing a Group III nitride substrate comprising: forming a Group III nitride layer including gaps 12c on a substrate 11; bringing a surface of the Group III nitride layer into contact with a melt containing alkali metal and at least one Group III element selected from gallium, aluminum and indium in an atmosphere containing nitrogen, to make at least one Group III element and the nitrogen react with each other to grow Group III nitride crystals on the Group III nitride layer (col. 17, lines 53-60); and separating a part including the substrate 11 and a part including the Group III nitride crystals 14 from each other in vicinities of the gaps 12c (fig. 4); wherein in the process the group III nitride layer including gaps includes a semiconductor layer expressed by a composition formula  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  (wherein  $0 \leq x \leq 1$  and  $0 \leq y \leq 1$ ), and after forming the semiconductor layer, the gaps are formed in the semiconductor layer or at the surface of the semiconductor layer through a temperature programmed heat treatment carried out in

an atmosphere of a mixture of ammonia and nitrogen (col. 22, lines 7-9). Dry etching is an equivalent substitution for heat treatment, because dry etching involves heat.

Kidoguchi et al. discloses the claimed method except for a cycle of the gaps is at least 100  $\mu\text{m}$ . It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a cycle of gaps at least 100  $\mu\text{m}$ , since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

With regard to claim 19, Kidoguchi et al. disclose the claimed invention except the Group III nitride layer including gaps is a semiconductor layer expressed by a composition formula of  $\text{Ga}_x\text{In}_{1-x}\text{N}$  (wherein  $0 \leq x \leq 1$ ). It would have been obvious to one having ordinary in the art at the time the invention was made to use the Group III nitride layer including gaps is a semiconductor layer expressed by a composition formula of  $\text{Ga}_x\text{In}_{1-x}\text{N}$  (wherein  $0 \leq x \leq 1$ ) (col. 1, lines 35-50).

With regard to claim 20, Kidoguchi et al. do not teach a temperature programmed heat treatment carried out at a programming rate of 50 to 100°C/min. Nonetheless, the choice of temperature is considered an obvious optimization to one of ordinary skill in the art at the time of the invention. The ranges claimed do not achieve any unexpected results over the prior art and are considered obvious. In re Aller, 105 USPQ 233. (CCPA 1955).

With regard to claim 21, Kidoguchi et al. teach the method wherein a cycle of gaps is at least 30  $\mu\text{m}$  (col. 22, lines 1-2).

With regard to claims 22 and 23, Kidoguchi et al. teach the claimed method except for a cycle of the gaps is at least 50  $\mu\text{m}$  and at least 100  $\mu\text{m}$ . It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a cycle of gaps at least 50  $\mu\text{m}$  and a cycle of gaps at least 100  $\mu\text{m}$ , since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kidoguchi et al. (US 6,720,586) in view of Koike et al. (US 6,471,770).

With regard to claim 4, Kidoguchi et al. discloses the claimed invention except a separation carried out using stress generated by a difference in coefficient of linear expansion between the substrate and the Group III nitride crystals. Koike et al. teach a GaN layer formed on a substrate layer that is separated apart using stress from thermal distortion which is a difference in coefficient of linear expansion between the substrate and the Group III nitride layer (col. 3, lines 55-58). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the method of Koike et al. in the method of Kidoguchi et al. The motivation for doing so is to use a technique that when the sample is cooled they are automatically separated from each other.

5. Claims 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kidoguchi et al. (US 6,720,586) in view of Sarayama et al. (US 6,592,663).



With regard to claim 12, Kidoguchi et al. teach forming convex portions by processing a surface of a substrate and growing a Group III nitride layer from upper surfaces of the convex portions to form a seed crystal substrate having gaps formed between the substrate and the Group III nitride layer (figures 4, col. 17, lines 53-60). Sarayama et al. teach bringing a surface of the Group III nitride layer into contact with a melt containing alkali metal and at least one Group III element selected from gallium, aluminum and indium in a pressurized atmosphere containing nitrogen, to make at least one Group III element and the nitrogen react with each other to grow Group III nitride crystals on the Group III nitride layer as set forth at column 5, lines 45-66 and figures 3, 4A-4B and Kidoguchi et al. teach separating a part including the substrate and a part including the Group III nitride crystals from each other in vicinities of the gaps (col. 24, lines 26-31). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the method of Sarayama et al. in the method of Kidoguchi et al. The motivation for doing so is to grow the Group III nitride crystal using a well known technique in the art.

Kidoguchi et al. and Sarayama et al. disclose the claimed method except for a cycle of the gaps is at least 100  $\mu\text{m}$ . It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a cycle of gaps at least 100  $\mu\text{m}$ , since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

With regard to claim 14, Sarayama teaches wherein the alkali metal is at least one selected from sodium, lithium and potassium (figures 4A and 4B).

6. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kidoguchi et al. (US 6,720,586) and Sarayama et al. (US 6,592,663) in view of D'Evelyn et al. (US 2004/0124434).

With regard to claim 15, Kidoguchi et al. and Sarayama et al. teach the claimed invention but do not teach the method wherein the melt further contains alkaline earth metal. However, D'Evelyn et al. teach that it is known to use a method wherein the melt comprises alkali and alkaline-earth nitrides. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the process as taught by D'Evelyn et al. in the process of Kidoguchi et al. et al. and Sarayama et al., since D'Evelyn et al. state in paragraphs [0030] and [0031] that such a modification in the methodology is preferred because of easier process control and higher quality crystals.

### ***Response to Arguments***

7. Applicant's arguments with respect to claims 1, 12 and 18 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to SONYA D. MCCALL SHEPARD whose telephone number is (571)272-9801. The examiner can normally be reached on Monday - Friday 8:00-4:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Zandra V. Smith/  
Supervisory Patent Examiner, Art  
Unit 2822

/S. D. M./  
Examiner, Art Unit 2813